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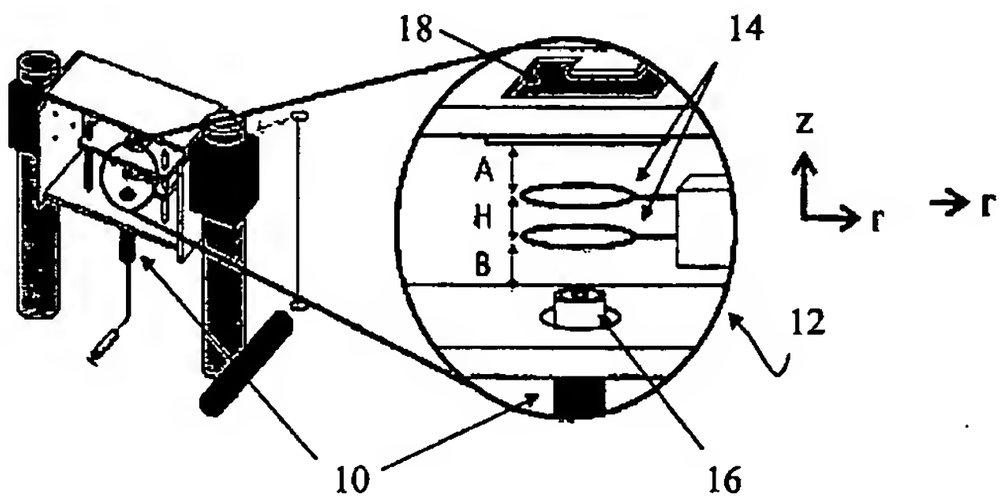
(54) Title: CONTROLLED NUCLEATION OF SOLUTES IN SOLUTIONS HAVING NET CHARGE TO PROMOTE CRYSTAL GROWTH



(57) Abstract: This application is concerned with the controlled nucleation of solutes (i.e. dissolved solids) from solution. It has been found that the energy barrier for dissolved solids to nucleate is affected by the surface charge density of the reaction vessel (and hence the mass-to-charge ratio of vessel). The reaction vessel may, for example, comprise a levitated droplet of the solution having an "excess net charge". That is, ions present in the vessel of a single polarity are in excess of the counterions of opposite polarity. An increase in the surface charge density of the vessel (and hence a reduction in the mass-to-charge ratio of the vessel) causes the barrier for nucleation to decrease. These findings can be exploited using instruments commonly used in wall-less sample preparation to elicit selective control over the induction of nucleation and subsequent crystallization of target solutes of interest in the condensed phase. The ion induced nucleation phenomenon, in reaction vessels having a desirable surface charge density, is likely to be general for all dissolved solids, ranging from inorganic compounds, to low and high molecular weight organic compounds, including proteins and other molecules. For example the present invention can be used to selectively crystallize a target solute or to separate different solutes from one another based on their propensity to nucleate at different reaction conditions. The different solutes could constitute different compounds or different stereochemical forms of same compound. The invention could also be exploited to controllably select or separate polymorphic forms of a compound (which may often have very different biological activity). The crystals derived from the process could be the subject of further analysis, characterization or manipulation, for example as a prepared sample for MALDI-TOF MS.

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